

Using LiDAR



LOS ANGELES REGION
LAR|@C
imagery acquisition consortium



Benjamin H. Houston, P.E., GISP, PMP



GROUNDPOINT
TECHNOLOGIES, LLC

$$\text{Value} = Q * S * E * N / \$$$

Q= # Questions Answered

S= Speed to deploy

E= Ease of use

N= Number of platforms able to gain access

The key element in achieving a LIDAR ROI, particularly for S, E, and N, is **derivative products.**



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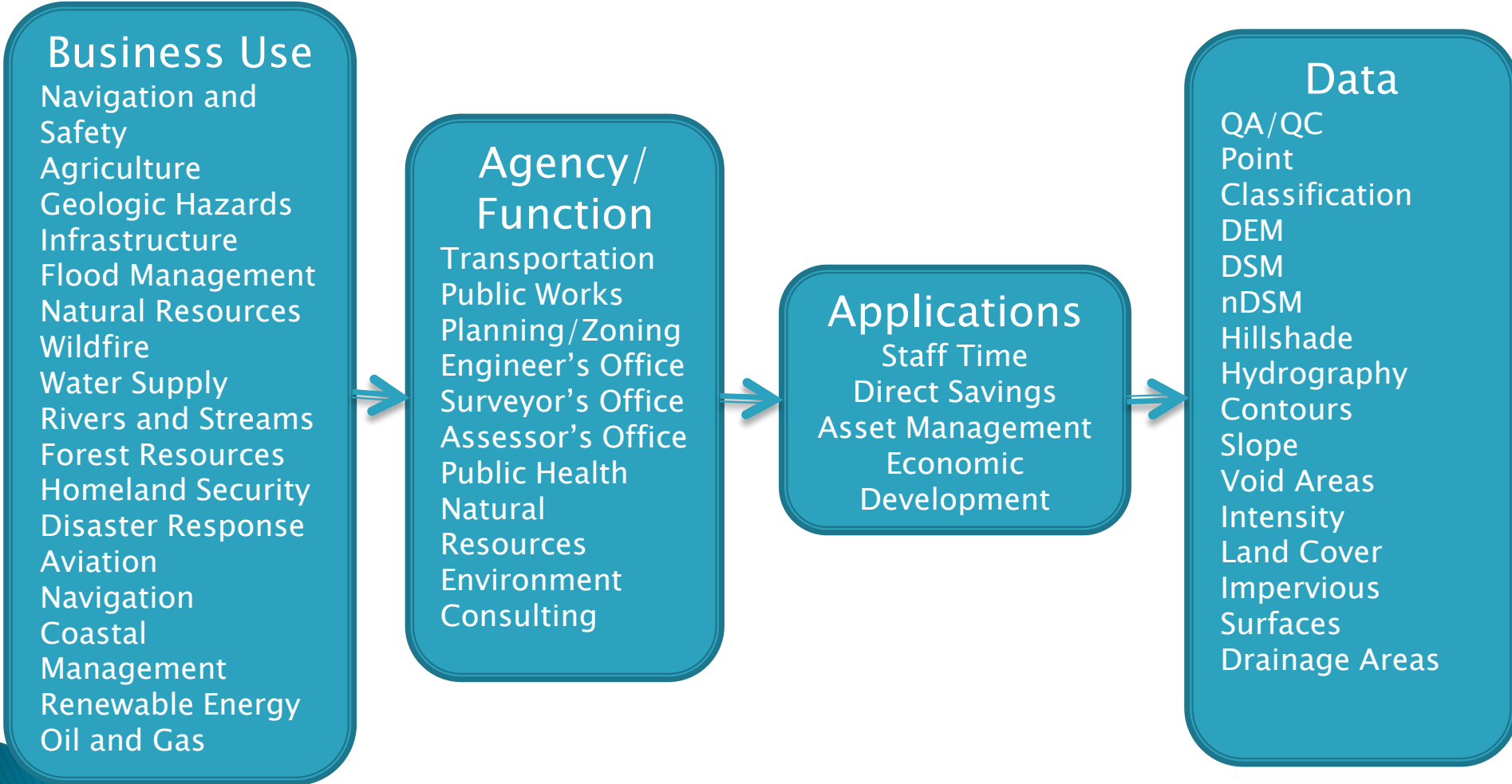
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Recent Reports

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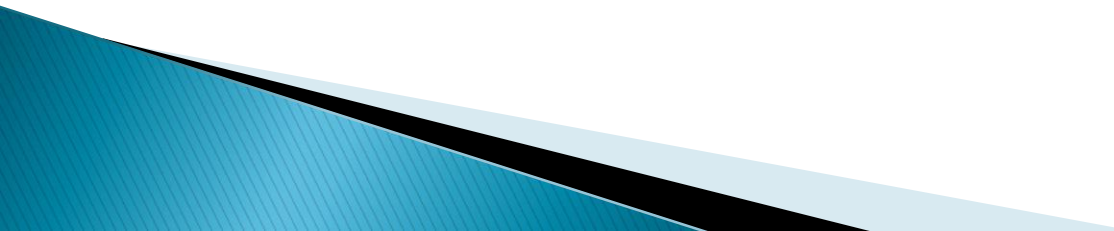
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Data

QA/QC
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DSM
nDSM
Hillshade
Hydrography
Contours
Slope
Void Areas
Intensity
Land Cover
Impervious Surfaces
Drainage Areas

LARIAC Deliverables

- ▶ Point Clouds LAS
 - ▶ DEM Raster
 - ▶ DSM and nDSM Raster
 - ▶ Hillshade Raster
 - ▶ Contours Vector
 - ▶ Hydrography Vector
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 - ▶ Void Areas Raster
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Information

Current version: 8.0.6.1

Latest release: October, 2016

What's new: Download PDF [here](#).

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QUICK TERRAIN READER

Free Viewing Software

The Quick Terrain Reader is the free companion software to Quick Terrain Modeler. The Quick Terrain Reader is capable of opening pre-built digital elevation models (DEMs) and point clouds and allows users to freely move through the terrain in a fast and intuitive way.

The current version of Quick Terrain Reader is 8.0.5. Should you have any problems loading your DEMs and/or point clouds, please first download the appropriate current version below.

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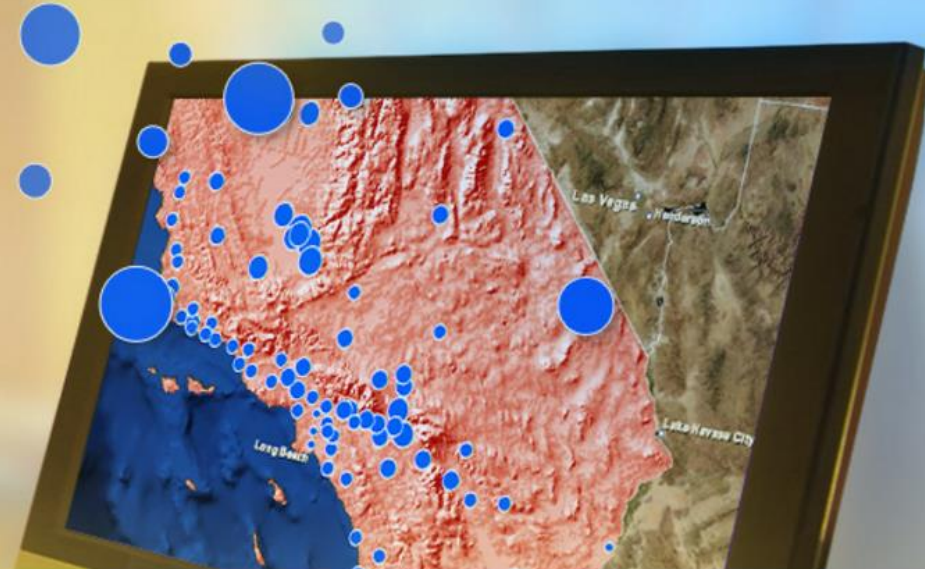
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Main

Features

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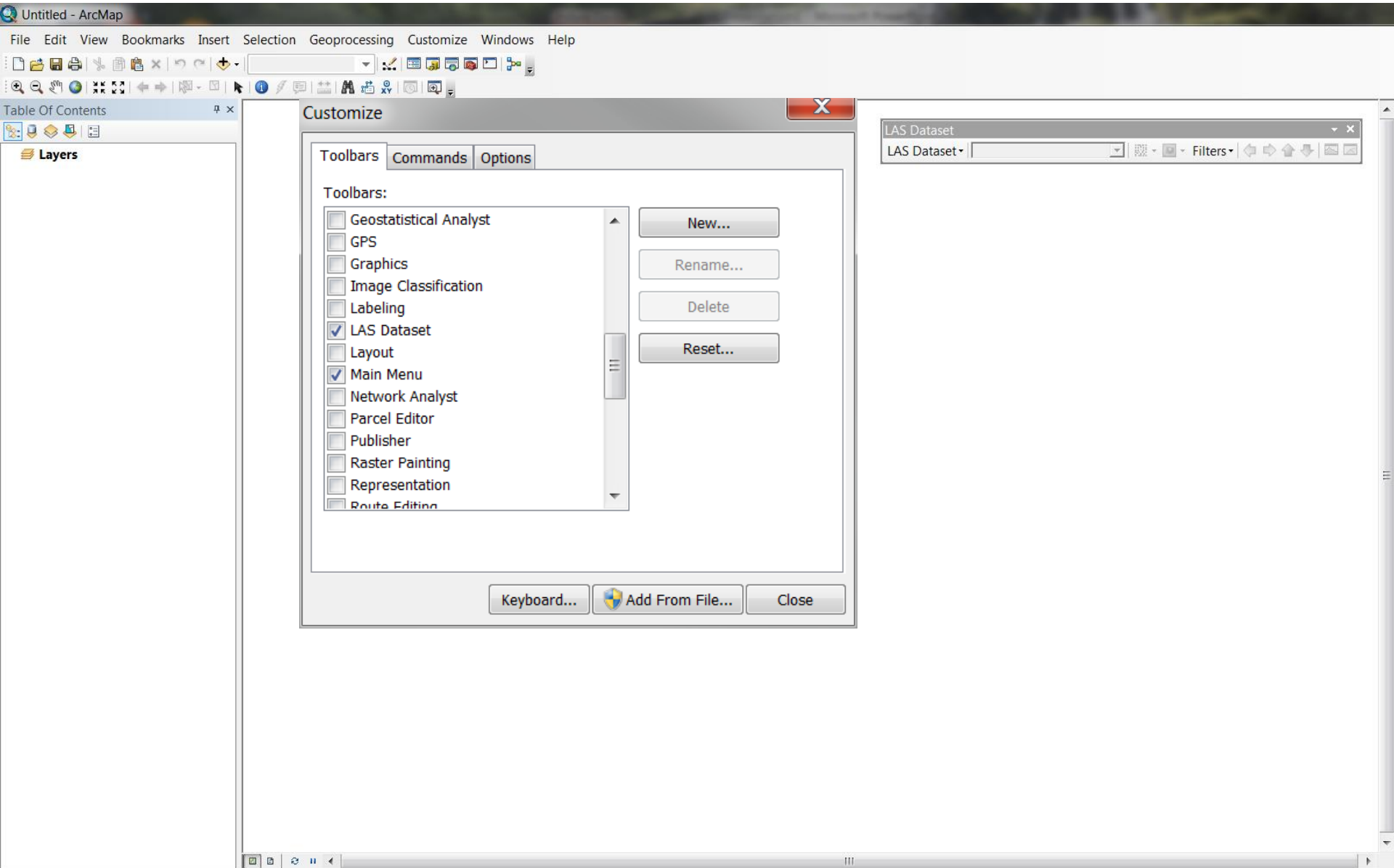
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There are lots of ways maps to make decision then you need to put Desktop to build maps deep analysis, and sha impact.

The World's Most Powerful GIS Environment for LIDAR and Photogrammetric Point Cloud Processing

Whether from airborne LIDAR or drone collected imagery, 3D point clouds have become a critical base mapping layer. LP360 provides tools from rapid visualization and derived product generation through advanced features such as automatic ground classification and building footprint extraction.

ArcGIS Options- LAS Dataset



ArcGIS Options

The screenshot displays the ArcGIS interface with the 'Extensions' dialog box open. The dialog box contains a list of extensions with checkboxes, a description for the 3D Analyst extension, and a 'Close' button. To the right of the dialog box, three extension toolbars are visible: 'LAS Dataset', '3D Analyst', and 'Spatial Analyst'. The '3D Analyst' toolbar is highlighted, indicating it is the active extension.

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

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Layers

Extensions

Select the extensions you want to use.

- 3D Analyst
- ArcScan
- Geostatistical Analyst
- Network Analyst
- Publisher
- Schematics
- Spatial Analyst
- Tracking Analyst

Description:

3D Analyst 10.3
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Provides tools for surface modeling and 3D visualization.

Close

LAS Dataset

3D Analyst

Spatial Analyst

A complete listing of the Spatial Analyst tool:

ArcGIS 10

[Locate topic](#)

The ArcGIS Spatial Analyst extension has over 170 tools in 23 toolsets for performing spatial analysis and modeling.

Spatial Analyst toolsets:

Toolset	Tools
Conditional	Con • Pick • Set Null
Density	Kernel Density • Line Density • Point Density
Distance	Corridor • Cost Allocation • Cost Back Link • Cost Distance • Cost Path • Euclidean Allocation • Euclidean Direction • Euclidean Distance • Path Distance • Path Distance Allocation • Path Distance Back Link
Extraction	Extract by Attributes • Extract by Circle • Extract by Mask • Extract by Points • Extract by Polygon • Extract by Rectangle • Extract Multi Values to Points • Extract Values to Points • Sample
Generalization	Aggregate • Boundary Clean • Expand • Majority Filter • Nibble • Region Group • Shrink • Thin
Groundwater	Darcy Flow • Darcy Velocity • Particle Track • Porous Puff
Hydrology	Basin • Fill • Flow Accumulation • Flow Direction • Flow Length • Sink • Snap Pour Point • Stream Link • Stream Order • Stream to Feature • Watershed

[Interpolation](#)

IDW • Kriging • Natural Neighbor • Spline • Spline with Barriers • Topo to Raster • Topo to Raster by File • Trend

[Local](#)

Cell Statistics • Combine • Equal to Frequency • Greater Than Frequency • Highest Position • Less Than Frequency • Lowest Position • Popularity • Rank

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[Math General](#)

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[Math Logical](#)

Boolean And • Boolean Not • Boolean Or • Boolean XOR • Combinatorial And • Combinatorial Or • Combinatorial XOR • Diff • Equal To • Greater Than • Greater Than Equal • In List • Is Null • Less Than • Less Than Equal • Not Equal • Over • Test

[Math Trigonometric](#)

ACos • ACosH • ASin • ASinH • ATan • ATan2 • ATanH • Cos • CosH • Sin • SinH • Tan • TanH

[Math Bitwise](#)

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Band Collection Statistics • Class Probability • Create Signatures • Dendrogram • Edit Signatures • Iso Cluster • Iso Cluster Unsupervised Classification • Maximum Likelihood Classification • Principal Components

Principal Components

[Neighborhood](#)

Block Statistics • Filter • Focal Flow • Focal Statistics • Line Statistics • Point Statistics

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Fuzzy Membership • Fuzzy Overlay • Weighted Overlay • Weighted Sum

[Raster Creation](#)

Create Constant Raster • Create Normal Raster • Create Random Raster

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Area Solar Radiation • Points Solar Radiation • Solar Radiation Graphics

[Surface](#)

Aspect • Contour • Contour List • Contour with Barriers • Curvature • Cut Fill • Hillshade • Observer Points • Slope • Viewshed • Viewshed 2 • Visibility

[Zonal](#)

Tabulate Area • Zonal Fill • Zonal Geometry • Zonal Geometry as Table • Zonal Histogram • Zonal Statistics • Zonal Statistics as Table

Spatial Analyst geoprocessing Toolsets and Tools

Related Topics

[An overview of the Spatial Analyst toolbox](#)

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Surface	Aspect • Contour • Contour List • Contour with Barriers • Curvature • Cut Fill • Hillshade • Observer Points • Slope • Viewshed • Viewshed 2 • Visibility
Zonal	Tabulate Area • Zonal Fill • Zonal Geometry • Zonal Geometry as Table • Zonal Histogram • Zonal Statistics • Zonal Statistics as Table

Spatial Analyst geoprocessing Toolsets and Tools

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[An overview of the Spatial Analyst toolbox](#)

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operations on surface models and three-dimensional vector data. The toolbox is conveniently organized into toolsets which define the scope of tasks accomplished by the tools therein.

3D Analyst tools provide the ability to create and analyze surface data represented in raster, terrain, triangulated irregular network (TIN), and LAS dataset formats. 3D data can be converted from a rich variety of formats, including COLLADA, lidar, SketchUp, OpenFlight, and many other data types. Analysis of geometric relationships and feature properties, interpolation of raster and various triangulated irregular network (TIN) models, and analysis of surface properties are only some of the numerous functions provided by the 3D Analyst tools.

[Learn more about surfaces and surface models](#)
[Learn more about feature data and 3D](#)

Toolset	Description
3D Features	Provides tools for evaluating geometric properties and relationships between three-dimensional features.
CityEngine	Contains tools that expose some capabilities of Esri CityEngine without requiring Esri CityEngine to be installed.
Conversion	Contains tools that convert feature classes, files, LAS datasets, rasters, TINs, and terrains to other data formats. The tools are organized into toolsets based on the data type being converted.
Data Management	Provides tools for creating and managing terrain, TIN, and LAS datasets.
Functional Surface	Provides analysis tools that evaluate elevation information from raster, terrain, and TIN surfaces.
Raster Interpolation	Provides numerous interpolation tools that can produce continuous raster surfaces from a given set of sample points, including hydrologically correct surface models.
Raster Math	Features tools that perform mathematical operations on raster datasets.
Raster Reclass	Contains tools that enable reclassification of raster data.
Raster Surface	Provides analysis tools that enable the determination of raster surface properties, such as contours, slope, aspect, hillshade, and difference calculation.
Triangulated Surface	Provides analysis tools that enable the determination of surface properties of TIN, terrain, and LAS datasets, such as contours, slope, aspect, hillshade, difference calculation, volumetric computations, and outlier detection.
Visibility	Features tools that enable visibility analysis to be performed using various types of observer features and obstruction sources that include surfaces, multipatches, which are great for representing structures like buildings, and 3D features.

Overview of toolsets in the 3D Analyst toolbox

Related Topics

- [What is geoprocessing?](#)
- [A quick tour of geoprocessing](#)
- [A quick tour of ArcPy](#)
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- TIN Triangle (3D Analyst) (Tool)**
Exports triangle faces from a TIN dataset to polygon features and provides slop...
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- Copy TIN (3D Analyst) (Tool)**
Creates a copy of a triangulated irregular network (TIN) dataset.
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- TIN Domain (3D Analyst) (Tool)**
Creates a class of polygon feature class representing the interpolation zone of a ...
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- Create TIN (3D Analyst) (Tool)**
Creates a triangulated irregular network (TIN) dataset.
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This tool imports one or more triangulated irregular network (TIN) surfaces fro...
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- Edit TIN (3D Analyst) (Tool)**
Adds features from one or more input feature classes that define the surface ar...
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- Raster To TIN (3D Analyst) (Tool)**
Converts a raster to a triangulated irregular network (TIN) dataset.
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- TIN Polygon Tag (3D Analyst) (Tool)**
Creates polygon features using tag values in a triangulated irregular network (T...
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- Terrain To TIN (3D Analyst) (Tool)**
Converts a terrain dataset to a triangulated irregular network (TIN) dataset.
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- Decimate TIN Nodes (3D Analyst) (Tool)**
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- Delineate TIN Data Area (3D Analyst) (Tool)**
Redefines the data area, or interpolation zone, of a triangulated irregular networ...
toolboxes\system toolboxes\3d analyst tools.tbx\data management\tin\delineat...
- TIN Compare (Data Management) (Tool)**
Compares two TINs and returns the comparison results. TIN Compare can rep...
toolboxes\system toolboxes\data management tools.tbx\data comparison\tin co...
- Surface Difference (3D Analyst) (Tool)**
Calculates the volumetric difference between two surface models stored as eith...
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TIN

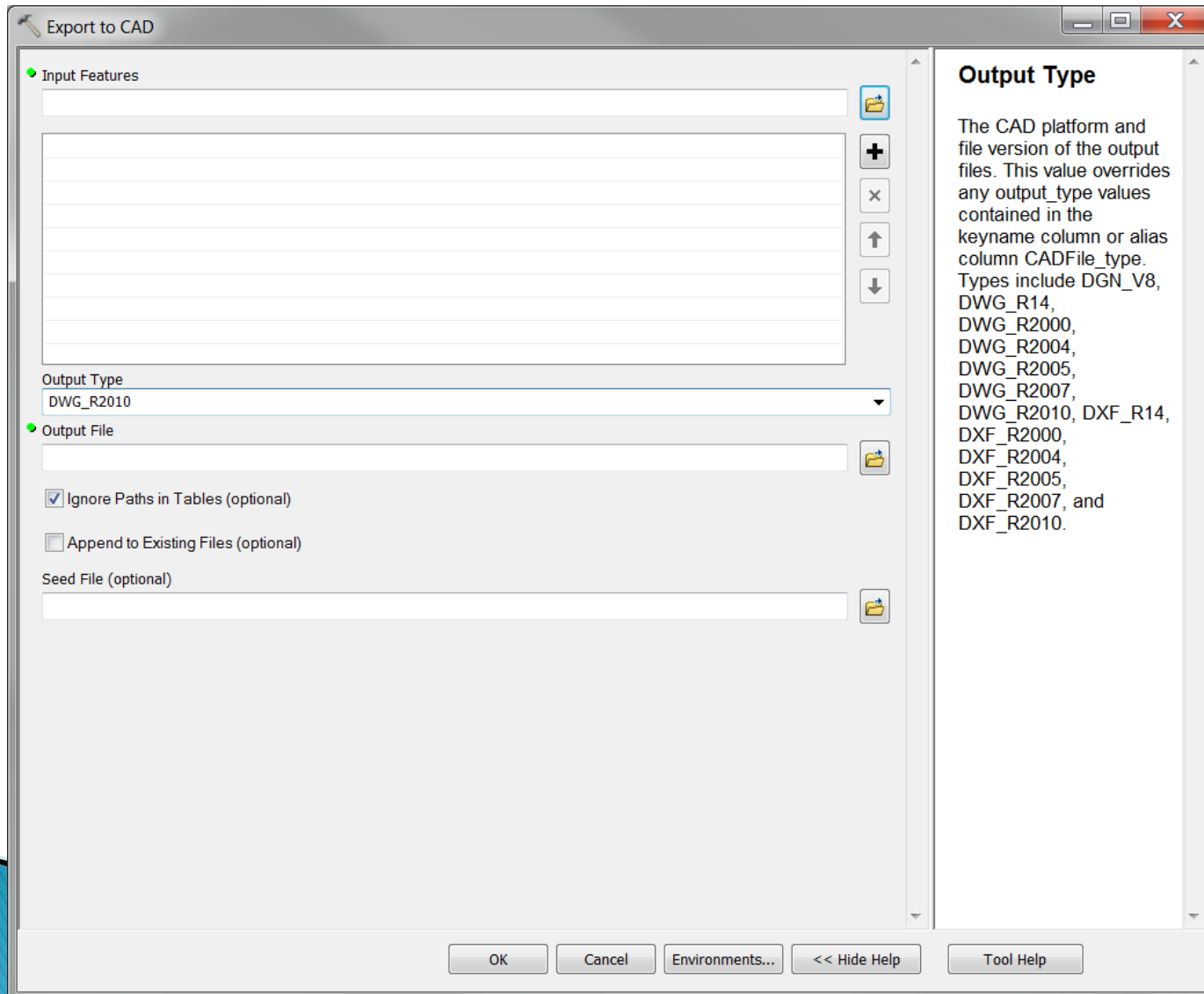
Any Extent

Search returned 33 items Sort By

- LandXML To TIN (3D Analyst) (Tool)**
This tool imports one or more triangulated irregular network (TIN) surfaces fro...
toolboxes\system toolboxes\3d analyst tools.tbx\conversion\from file\landxml t...
- Edit TIN (3D Analyst) (Tool)**
Adds features from one or more input feature classes that define the surface ar...
toolboxes\system toolboxes\3d analyst tools.tbx\data management\tin\edit tin
- Raster To TIN (3D Analyst) (Tool)**
Converts a raster to a triangulated irregular network (TIN) dataset.
toolboxes\system toolboxes\3d analyst tools.tbx\conversion\from raster\raster t...
- TIN Polygon Tag (3D Analyst) (Tool)**
Creates polygon features using tag values in a triangulated irregular network (T...
toolboxes\system toolboxes\3d analyst tools.tbx\conversion\from tin\tin polygo...
- Terrain To TIN (3D Analyst) (Tool)**
Converts a terrain dataset to a triangulated irregular network (TIN) dataset.
toolboxes\system toolboxes\3d analyst tools.tbx\conversion\from terrain\terrain...
- LAS Dataset To TIN (3D Analyst) (Tool)**
Exports a triangulated irregular network (TIN) from a LAS dataset.
toolboxes\system toolboxes\3d analyst tools.tbx\conversion\from las dataset\la...
- Decimate TIN Nodes (3D Analyst) (Tool)**
Creates a triangulated irregular network (TIN) dataset using a subset of nodes f...
toolboxes\system toolboxes\3d analyst tools.tbx\triangulated surface\decimate ...
- Delineate TIN Data Area (3D Analyst) (Tool)**
Redefines the data area, or interpolation zone, of a triangulated irregular networ...
toolboxes\system toolboxes\3d analyst tools.tbx\data management\tin\delineat...
- TIN Compare (Data Management) (Tool)**
Compares two TINs and returns the comparison results. TIN Compare can rep...
toolboxes\system toolboxes\data management tools.tbx\data comparison\tin co...
- Surface Difference (3D Analyst) (Tool)**
Calculates the volumetric difference between two surface models stored as eith...
toolboxes\system toolboxes\3d analyst tools.tbx\triangulated surface\surface dif...

1 2

CAD



The following table lists the field names that are reserved for reading and writing DWG/DXF CAD data in ArcGIS for Desktop. You can use them to override the default output of the [Export To CAD](#) tool by adding them to the input feature class table. Fields marked as read-only are exclusive to direct-read CAD (virtual) attribute tables and cannot be used.

Category	Field name	Data type	Length	Description
Entity properties	FID	ObjectID	4	A unique feature identifier <ul style="list-style-type: none"> • Read-only
	Shape	Geometry	-	The ArcGIS area shape representing the spatial extent of the CAD file <ul style="list-style-type: none"> • Read-only
	Entity	String	16	The CAD entity <ul style="list-style-type: none"> • Read-only
	Handle	String	16	A unique CAD entity identifier <ul style="list-style-type: none"> • Read-only
	Angle	Double	8	Rotation angle in degrees <ul style="list-style-type: none"> • Point and annotation feature classes only
	<attribute name>	Text, Long, or Double	8	A named user-defined textual entity used for storing data in a block insert
	BlkColor	Short	2	The color assigned to the block expressed as an integer
	BlkLinetype	String	255	The line type of the block with which the entity is associated
	BlkLineWt	Short	2	The line weight of the block with which the entity is associated
	CadType	String	255	A valid value overrides the default output entity type. For example: <ul style="list-style-type: none"> • 3D Polyline outputs POLYLINE entities instead of the default LWPOLYLINE.

The following table lists the reserved CAD fields that can be used to override the default values for the fields in the CAD file. The fields are read-only in direct-read CAD (virtual CAD).

Category

Entity properties

Color	Short	2	The display color of the entity expressed as an integer. <ul style="list-style-type: none"> For annotation, 256 sets color ByLayer.
Elevation	Double	8	The z-coordinate value of an entity. <ul style="list-style-type: none"> For entities with multiple z-coordinates, this is the z-coordinate for the first point of the entity as defined by the CAD application.
EntColor	Short	2	The assigned color of the entity expressed as an integer
EntLinetype	String	255	The assigned line type of the entity
EntLineWt	Short	2	The assigned line weight of an entity
ExtX	Double	8	The x-coordinate extrusion value <ul style="list-style-type: none"> Read-only
ExtY	Double	8	The y-coordinate extrusion value <ul style="list-style-type: none"> Read-only
ExtZ	Double	8	The z-coordinate extrusion value <ul style="list-style-type: none"> Read-only
LineWt	Short	2	The display line weight of an entity
Linetype	String	255	The display line type of the entity
LTScale	Double	8	The scale of the entity's line type
RefName	String	255	The name of the parent object in which the entity resides
ScaleX	Double	8	The x-coordinate scale value <ul style="list-style-type: none"> Point and annotation only
ScaleY	Double	8	The y-coordinate scale value <ul style="list-style-type: none"> Point and annotation only

The following table lists the reserved CAD fields that you can use to override the default values for direct-read CAD (virtual) entities.

Category

Entity properties

Color	ScaleZ	Double	8	The z-coordinate scale value <ul style="list-style-type: none"> Point and annotation only
	Thickness	Double	8	The extrusion distance of an entity <ul style="list-style-type: none"> Read-only
Elevation	Layer	String	255	The CAD drawing layer name
	LyrColor	Short	2	The CAD drawing layer color expressed as an integer
EntColor	LyrFrzn	Short	2	The freeze/thaw state of the CAD drawing layer
EntLinetype	LyrHandle	String	16	A unique CAD drawing layer identifier <ul style="list-style-type: none"> Read-only
EntLineWt				
ExtX	LyrLinetype	String	255	The line type of the CAD drawing layer in which the entity resides
	LyrLineWt	Short	2	The line weight of the CAD drawing layer in which the entity resides
ExtY	LyrLock	Short	2	The lock/unlock state of the CAD drawing layer
	LyrOn	Short	2	The on/off state of the CAD drawing layer
ExtZ	LyrVPFrzn	Short	2	The freeze/thaw state of the CAD view port
LineWt				
Linetype	FontId	Short	2	The ArcGIS text symbol ID <ul style="list-style-type: none"> Read-only
LTScale				
RefName	Height	Double	8	The text height in CAD units
	LnSpace	Short	2	The multiline text spacing type <ul style="list-style-type: none"> Read-only
ScaleX				
	SpaceFact	Double	8	The multiline text spacing factor <ul style="list-style-type: none"> Read-only
ScaleY				
	TxtStyle	String	255	The text style

The following table lists the fields that can be used to override the default values for direct-read CAD (virtually all) fields.

Category
Entity properties

Field Name	Field Type	Field Size	Description
Color	String	255	The text style
Text	String	255	The text string
Thickness	Short	2	The multiline text attachment parameter
Layer	Double	8	The text entity bounding box height
LyrColor	Double	8	The text entity bounding box width
LyrFrzn	Short	2	The multiline text direction parameter
LyrHandle	String	255	The text entity CAD font
LyrLinetype	String	32	The text generation type
LyrLineWt	Double	8	The text entity height
LyrLock	String	32	The text entity justification parameter
LyrVPFrzn	String	2048	The entire text string, not truncated
FontId	Double	8	The text entity oblique angle
Height	Double	8	The multiline text width factor
LnSpace	Double	8	The text entity rotation angle
SpaceFact	String	255	The text string for new text created from point features when the field CADType contains the keyword TEXT.
TxtStyle	Double	8	The text entity width factor.
TxtValue	String	32	The text entity vertical alignment parameter
TxtWidth	String	32	The text entity vertical alignment parameter
VertAlign	String	32	The text entity vertical alignment parameter

- Read-only

The following table lists the reserved CAD fields that you can use to override the default values for direct-read CAD (virtually all AutoCAD files).

Category	Field Name	Field Type	Field Value	Description				
Entity properties	Color	ScaleZ	TxtStyle	TxtOblique	Double	8	The text entity style	• Read-only
		Thickness	Text	TxtRefWd	Double	8	The multiline text style	• Read-only
	Elevation	Layer	TxtAttach	TxtBoxHt	Double	8	The text entity rotation	
		LyrColor	TxtBoxWd	TxtRotate	Double	8	The text entity rotation	
	EntColor	LyrFrzn	TxtDir	TxtValue	String	255	The text string for point features which contains the key	
	EntLinetype	LyrHandle	TxtFont	TxtGenType	Double	8	The text entity width	• Read-only
	EntLineWt	LyrLinetype	TxtGenType	TxtHt	String	32	The text entity width	• Read-only
	ExtX	LyrLineWt	TxtHt	TxtJust	String	32	The text entity vertical alignment	• Read-only
		LyrLock	TxtJust	TxtMemo	String	255	The text entity vertical alignment	• Read-only
	ExtY	LyrOn	TxtMemo	TxtOblique	String	255	The file name of the drawing	extension
	ExtZ	LyrVPFrzn	TxtOblique	TxtRefWd	String	4096	The full path of the drawing	file name
	LineWt	FontId	TxtRefWd	TxtRotate	String	255	The file name of the drawing	• DocPath can be used to specify a single feature in drawings which are unchecked in the dialog box.
	Linetype	Height	TxtRotate	TxtValue	String	255	The file extension of the drawing	format
	LTScale	LnSpace	TxtValue	TxtWidth	String	16	The CAD format of the drawing	
	RefName	SpaceFact	TxtWidth	VertAlign	String	16	The CAD format of the drawing	
	ScaleX	TxtStyle	VertAlign					

DWG/DXF formats.

[CAD drawings output](#)

Recent Reports

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Water Supply
Rivers and Streams
Forest Resources
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Disaster Response
Aviation
Navigation
Coastal Management
Renewable Energy
Oil and Gas

Agency/ Function

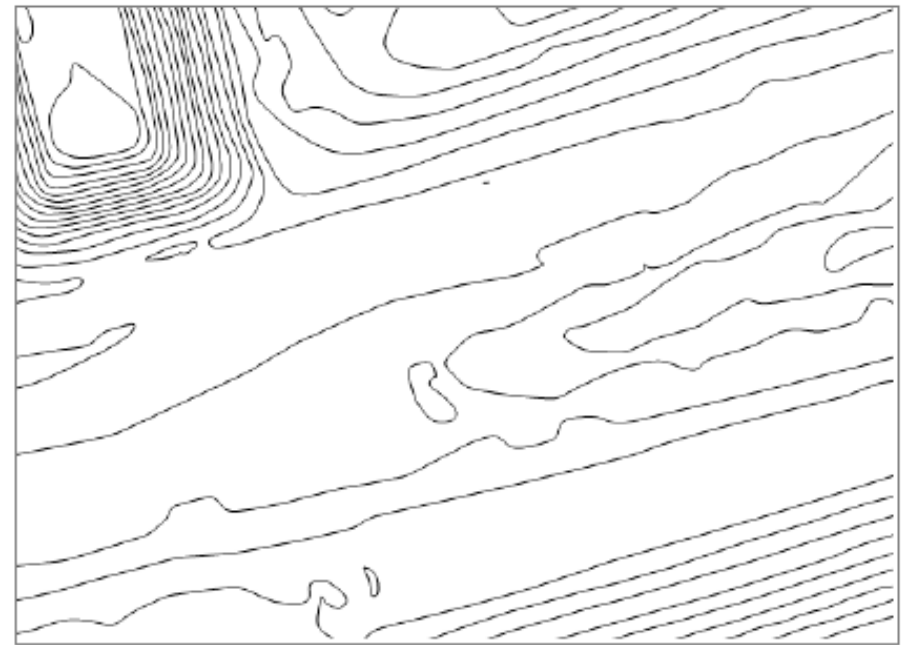
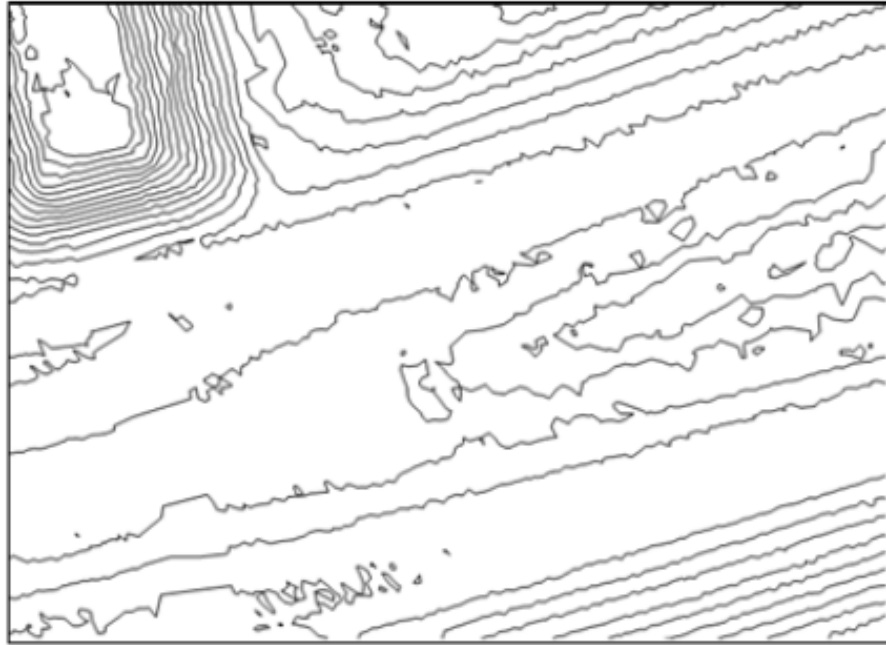
Transportation
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Direct Savings
Asset Management
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Data

QA/QC
Point Classification
DEM
DSM
nDSM
Hillshade
Hydrography
Contours
Slope
Void Areas
Intensity
Land Cover
Impervious Surfaces
Drainage Areas



A. Contours derived straight from lidar surface

B. Same contours edited to produce a more intuitive product, but with lowered accuracy

Figure 3-8. Contours generated from lidar data

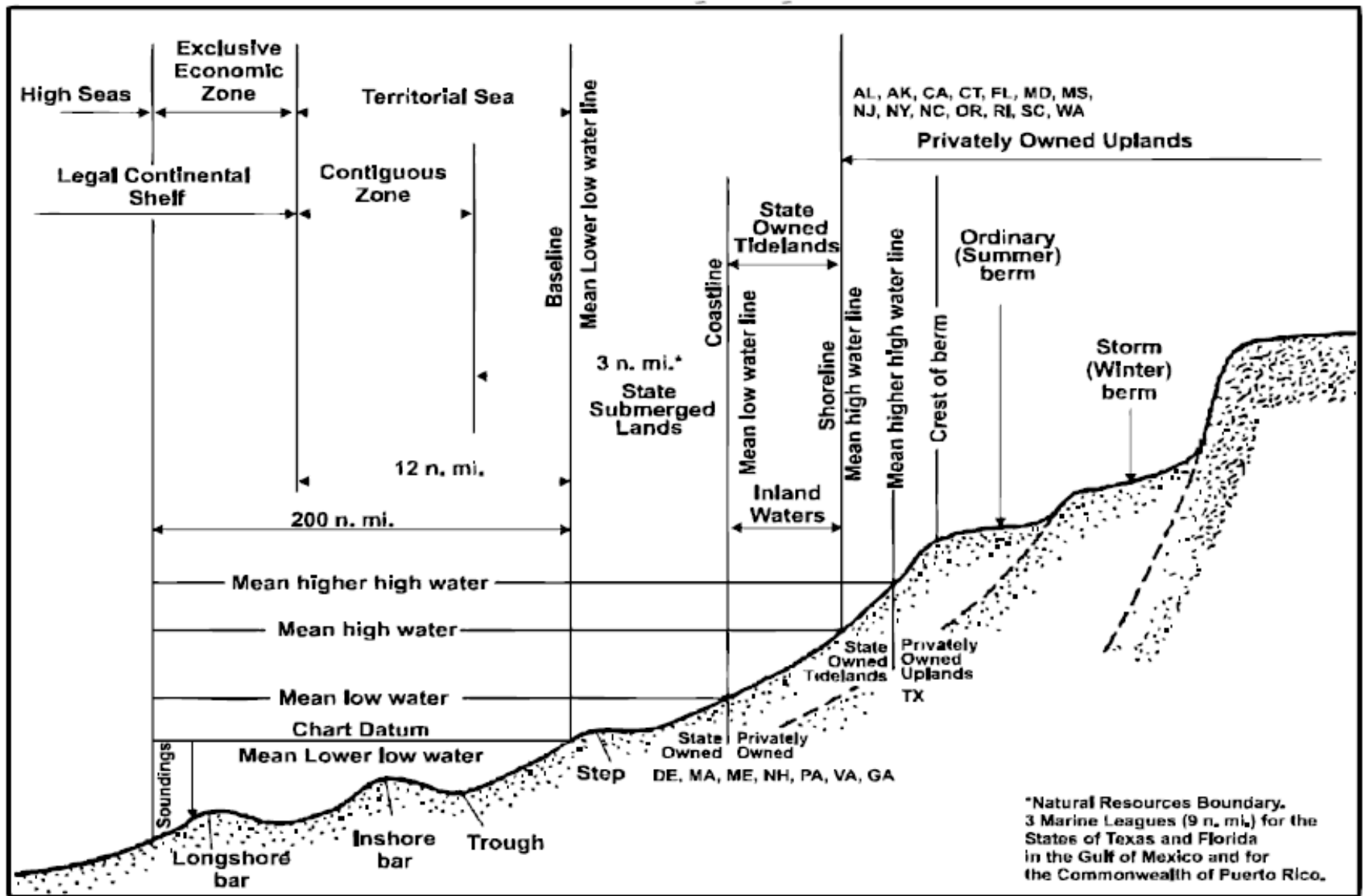


Figure 6-1. Legal significance of shoreline where the intersection of the tidal datum with land determines the landward edge of a marine boundary (Gill and Schultz, 2001; reprinted courtesy of NOAA)

ESRI Report

- ▶ Staff Time
- ▶ Direct Savings (Cost Avoidance)
- ▶ Asset Management
- ▶ Economic Development



The GIS Guide for Elected Officials

edited by **Cory Fleming**,
International City/County
Management Association (ICMA)

FINAL REPORT

**BUSINESS PLAN FOR
THE IOWA GEOSPATIAL INFRASTRUCTURE**

**PRESENTED TO
THE IOWA GEOGRAPHIC INFORMATION COUNCIL**

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IGIC Report

- ▶ Dept of Transportation
 - ▶ Dept of Public Works
 - ▶ Dept of Planning/Zoning
 - ▶ Dept of Public Health
 - ▶ Dept of Natural Resources
 - ▶ County Engineer/Surveyor
 - ▶ County Assessor
-
- ▶ Economic Development
 - ▶ Emergency Services



Prepared in cooperation with the Federal Emergency Management Agency,
the National Geospatial-Intelligence Agency, and
the Natural Resources Conservation Service

National Requirements for Enhanced Elevation Data

By Gregory I. Snyder, Larry J. Sugarbaker, Allyson L. Jason, and David F. Maune

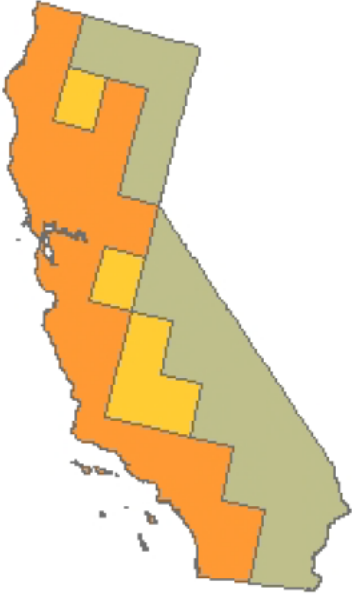
Table 2. Aggregated benefits from enhanced elevation data.


[Data are presented sorted by conservative benefits. —, reported benefits less than 1 million (M)]

Business use	Annual benefits from enhanced elevation data, in million dollars	
	Conservative benefits	Potential benefits
Flood risk management	295	502
Infrastructure and construction management	206	942
Natural resources conservation	159	335
Agriculture and precision farming	122	2,011
Water supply and quality	85	156
Wildfire management, planning, and response	76	159
Geologic resource assessment and hazard mitigation	52	1,067
Forest resources management	44	62
River and stream resource management	38	87
Aviation navigation and safety	35	56
Coastal zone management	24	42
Renewable energy resources	10	100
Oil and gas resources	10	100
Homeland security, law enforcement, disaster response	10	126
Sea level rise and subsidence	6	22
Urban and regional planning	4	69
Resource mining	2	5
Wildlife and habitat management	2	4
Education K–12 and beyond	—	2
Land navigation and safety	—	7,125
Telecommunications	—	2
Recreation	—	—
Cultural resources preservation and management	—	7
Health and human services	—	1
Marine navigation and safety	—	—
Real estate, banking, mortgage, insurance	—	—
Rangeland management	—	—
Total estimated annual dollar financial benefits	1,180	12,981

Appendix 2. State, Territory, Local, and Tribal Government Requirements and Benefits Data

State Functional Activities

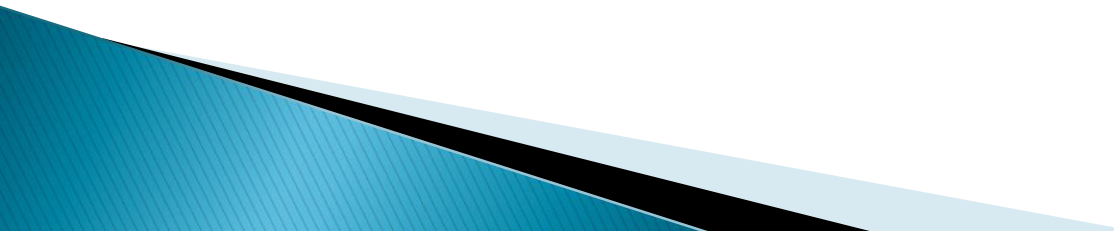
Program: Coastal Planning; Delta Levees; Agriculture and Precision Farming	Business Use: 14. Flood Risk Management
 <p>Quality Level:</p> <p>1 2 3 4 5</p>	<p>Flood Risk Mapping and Flood Assessment: Primary flood risk mapping activities that require elevation data or for which better elevation data would improve functional activities:</p> <ul style="list-style-type: none"> <li>• identification of low lying areas vulnerable to sea level rise <li>• information about the hydrological processes that occur at a regional scale <li>• characterization of existing shoreline protection devices which will further assist with climate change adaptation planning <li>• assessment of levees
<p>Update Frequency: 6–10 years</p>	<p>Estimated Annual Operational Benefits: Major; dollar value not reported Improved operational mapping and defensible science-based decisionmaking for planning purposes, monitoring, restoration, and protection.</p>
<p>Bathymetric Data: Yes</p>	<p>Estimated Annual Customer Service Benefits: Major; dollar value not reported Improved transparency, improved public safety, improved emergency response time, improved water availability, and quality.</p>
<p>Tide-Coordinated: Yes</p>	<p>Estimated Strategic Benefits: Major Improved preservation of life and property.</p>
<p>Data Outside State Needed: No</p>	

Program: Cost Recovery; Fire Protection	Business Use: 16. Wildfire Management, Planning, and Response
	<p>Fire Response, Fire Behavior Modeling, Post-Fire Damage Assessment and Litigation: Primary fire-related activities that require elevation data or for which better elevation data would improve functional activities are grouped into three categories:</p> <ul style="list-style-type: none"> <li>• preburn statewide QL5: used for assessment in most areas in California

California

- ▶ Coastal Planning:
 - characterization of existing shoreline protection
- ▶ Cost Recovery; Fire Protection
 - improved post fire vulnerability assessment (landslides and debris flows) to minimize loss of life and property.
- ▶ Ecosystem Assessment and Evaluation
 - improved storm and tsunami readiness
 - planning for restoration projects and fish passage improvement (coastal stream, beach, water diversions)
 - revision of wetland inventory maps
- ▶ Highway Design; Hydraulics;
 - reduce or eliminate the need to pay for survey data

California

- ▶ Land Cover Mapping
 - Reduce fire threat
 - ▶ Geologic Hazard Mitigation
 - Reduce time in the field
 - ▶ Urban and Regional Planning
 - Environmental/land use planning, flood risk planning
 - ▶ River and Stream Resource Management
 - Hydrologic and drainage mapping
 - ▶ Parcel Slope Analysis
 - 1:1200 scale mapping, 2 hrs saved per instance of use
- 

Returns: Staff Time

Job Function	Layers	Benefit Description
Transportation Engineer	Hydrography Elevation Transportation	Labor avoidance incorporating found points into DOT system = 90 hours/year
Environmental Specialist	Hydrography Elevation	Labor avoidance acquiring, creating and manipulating hydrology = 510 hours/year
Environmental Specialist	Hydrography Elevation	Watershed Improvement – improvements to watershed modeling for sediment delivery = 200 hours/year
Environmental Specialist	Hydrography Elevation	Water Quality NPDS – point discharge permit locations, how far from streams, where does it drain = 180 hours/year
Environmental Engineer	Hydrography Elevation	Floodplain Management - floodplain determinations for buildings = 600 hours/year
County Planning/Zoning	Elevation Building Footprints	Site planning savings for structures =40 hrs/yr
County Planning/Zoning	Elevation	Viewshed analysis for cell towers and wind farms. =40 hrs/yr
County Sheriff Deputies	Elevation Building Footprints	Emergency preparedness savings for structures = 10 hrs/yr
County Public Health Inspector	Elevation/ Hydrography Building Footprints	Time savings from using aerial survey data = 40 hrs/yr



Returns: Direct Savings

Job Function	Layers	Benefit Description
County SWCD USDA CREP Program	Elevation Hydrography	Cost avoidance of preliminary surveys, engineering services, and surveys for wetland structures. = \$67,500/year
County Planning Department	Elevation Transportation	Cost avoidance for Transportation Planning = \$24,000/yr
County Level (General Benefits)	Elevation	Avoidance of survey crew time for preliminary design = \$50,000/yr
County Highway Department	Elevation Transportation	Avoidable road maintenance costs using LIDAR for analysis = \$92,200/yr
County Highway Department	Elevation Transportation	Cost avoidance for preliminary surveys for roads and culverts = \$50,000/yr
County Engineer's Office	Elevation Transportation	Avoidance of survey crew time for preliminary design 20 crew days/year at \$150/hour = \$24,000/yr
County Surveyor	Elevation Transportation	25% of total time on any one field work project reduced = \$75,000/yr



Returns: Asset Management

- ▶ Tie as-built infrastructure to elevations
- ▶ Better planning for emergency events
- ▶ Support MS4 regulatory requirements

Returns: Economic Development

- ▶ Real estate property topo surveys
 - \$1,000–\$5,000 per lot
- ▶ Agricultural drainage
 - ~\$5/acre, 100 acres = \$500
 - \$3200/mi²
- ▶ Conservation and Environmental Assessments
 - 10–20 hours → 30–60 minutes
 - Avoid need for onsite field surveys

Using LiDAR



LOS ANGELES REGION
LAR|@C
imagery acquisition consortium



Benjamin H. Houston, P.E., GISP, PMP



GROUNDPOINT
TECHNOLOGIES, LLC